

# City of Bath Maine

## A Small Landfill's Preliminary Evaluation of Carbon Credits and Renewable Energy Projects

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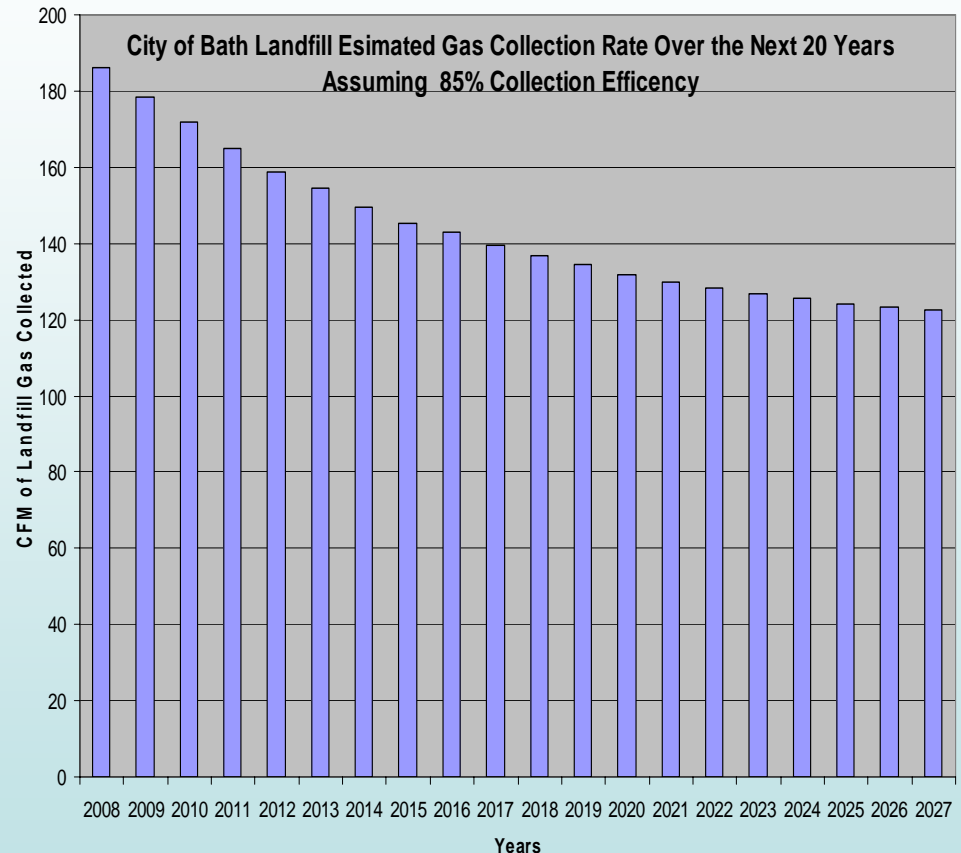
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Cumberland Center, Maine

# Presentation

- **Background**
- **Bath's Approach to the Carbon Credit Market**
- **Bath's Preliminary Assessment of Potential Renewable Energy Projects**

# Bath Landfill

- Been Used Since 1945 for the Disposal of Municipal Solid Waste
- Has about 1,100,000 Cubic Yards of In-place Waste
- Remaining Capacity of 500,000 Cubic Yards
- Began Flaring Landfill Gas in January of 2008



# Bath's Approach to the Carbon Credit Market

- Complete Preliminary Analysis and Valuation of Potential Carbon Credits Associated with Flaring Landfill Gas
- Prepare Project Documentation Report
- Validate and Verify Emission Reductions
- Sell Credits



# Step 1 in Preliminary Analysis & Valuation of Carbon Credits

- Assess Conformance with the Eligibility Requirements of Three Carbon Credit Protocols
  - Project Start Date
  - Monitoring of Landfill Gas Flow Data and Methane Concentration
  - Calibration of Monitoring Equipment
  - Carbon Offset Credit Ownership
  - Additionality (Project Tests)
    - Regulatory Surplus
    - Implementation Barrier
    - Common Practice

# Step 2 in Preliminary Analysis & Valuation of Carbon Credits

- Estimate Potential Value of Carbon Credits Under Each Protocol

**Methane Captured x Combustion Efficiency x  
(Global Warming Potential) - Project Emissions X  
Value of Carbon Credit**

- Potential Carbon Credits and Value from Flaring Landfill Gas over the Next Five Years

VCS	76,300 tonnes	\$381,000
CCX	77,900 tonnes	\$ 86,000
RGGI	83,600 tonnes	\$334,000

# Recommendation from Preliminary Analysis

- Begin Preparing the Project Document Report Such That the Project Can be Verified by January of 2010
- Install Electronic Recording Device That Records the Gas Flow Rates
- Install Methane Concentration Analyzer that Records the LFG Methane Concentration
- Calibrate Equipment and Maintain Records of Calibration.

# Approach to Evaluate Renewable Energy Projects

- Identify Potential Projects Based on Gas Energy Content, Locations and Current Energy Uses
- Evaluate the Economic Feasibility of the Projects Under Both Public and Private Ownership



# Renewable Energy Projects Evaluated

- **Onsite Options**

- **Power Generation with Reciprocating Engines** (produces approx. 2,009,000 Kw-hr per year)
- **Power Generation with Micro-Turbines** (produces approx 2,139,000 Kw-hr per year)
- **Heating of Onsite Structures** (replaces 1,600 gallons fuel oil)

- **Offsite Options**

- **Heating of Town Garage** (replaces 8,925 gallons of fuel oil)
- **Heating of Middle School** (replaces 63,100 gallons of fuel oil)
- **Cogeneration at both Town Garage or Middle School** (produces 2,139,000 Kw-hr & all Fuel for Garage & 50% for Middle School)

# Landfill Gas Utilization Equipment



Reciprocating Engine Generators



Micro Turbines



Gas Conditioning Unit



Radiant Heater

# Cost Considerations

- Capital Costs
  - Purchase and Install Equipment
  - Connection to the Power Grid
  - Gas Treatment
  - Indirect Costs
    - Engineering, Permitting, Legal and Finance
- Operational Costs
  - Power to Operate System
  - Gas Treatment Media Replacement
  - General Operations and Maintenance Cost
- Other Costs
  - Capital Replacement Funds
  - Capital Financing Costs

# Revenues

- Direct Power Sales = 39 to 50 %
- Renewable Energy Credits = 21 to 29 %
- Carbon Credits = 15 to 21%
- Section 45 Tax Credits = 3 to 8% (for Private Development)
- Heat Cost Offset Value = 9 to 86%

Power Sales at \$0.065 per Kw-hr

REC Sales at \$0.035 per Kw-hr

Carbon Credits at \$5.00 per tonne

Section 45 Tax Credits at \$0.01 per Kw-hr

Heating offsets at \$3.00 per gallon

# LIFE CYCLE ANALYSIS

Project	Public Pay-Back Period (yr)	Private Net Present Value @ 10%
Power Generation with Reciprocating Engines	6+	-\$237,000
Power Generation with Micro-Turbines	NMF	-\$192,000
Heating of Onsite Structures	NE	NE
Heating of Town Garage	NE	NE
Heating of Middle School	1	NE
Cogeneration at Town Garage	NMF	-\$432,000
Cogeneration at Middle School	9+	-\$638,000

# Conclusions of Renewable Energy Evaluation

- The Amount of Landfill Gas Collected at the Bath Landfill is Adequate to Support Several Renewable Energy Projects
- The Economics of the Projects are Very Sensitive to Site Specific Considerations such as Gas Quality & Market Forces such as Heating Oil Costs and Power Prices
- The Environmental Attributes Such as REC's and Carbon Credit are Very Important to the Economics of the Project